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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/634,964

08/05/2003

Zhendong Liu

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ROHM AND HAAS ELECTRONIC MATERIALS  
CMP HOLDINGS, INC.  
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EXAMINER

GEORGE, PATRICIA ANN

ART UNIT

PAPER NUMBER

1765

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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3 MONTHS

02/05/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

## Office Action Summary

Application No.

10/634,964

Applicant(s)

LIU, ZHENDONG

Examiner

Patricia A. George

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1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 11/16/2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1, 2 and 4-6 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1, 2, 4-6 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 2, 4, 5, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sun et al (US Patent No. 6,709,316) in view of Sherber et al. (5,858,813), evidenced by Changzhou Kejia Chemical Co. (Product Detail Poly (Maleic Acid)) and Wikipedia; Maleic Acid

([http://www.echinachem.com/kejiachem.co/Product\\_Detail.aspx?Gold\\_Product\\_Profile\\_ID=404](http://www.echinachem.com/kejiachem.co/Product_Detail.aspx?Gold_Product_Profile_ID=404)).

The reference of Sun et al discloses an aqueous chemical mechanical planarizing composition (col. 9, l. 14). The composition *comprises an oxidizer* in the form of promoting barrier removal since the composition is for the same (col. 6, lines 57-59); an abrasive in the form of (col. 7, lines 9-12); an inhibitor in the form of (*for decreasing removal of a metal interconnect*) (col. 6, lines 59-65). In addition, Sun et al. clearly discloses ph-adjusting agent/s can adjust the CMP composition to a range of about 2.5 to about 11, which encompassed the claimed less than 4. Sun et al. also clearly explain the adjusting agents can be comprised of bases, inorganic acids, and/or organic acids (col.6, l.66 to col.7, l.3). Sun teaches a tantalum nitride removal rate of at least eighty percent of copper removal rate (col.3, lines32-34), and also at 1:0:0 removal

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rate which indicates that 100% of the barrier layer (i.e. TaN) is removed relative to 0% of the copper and 0% of the dielectric. In addition Sun teaches a pad pressure of 13.8 kPa. (col. 12, line 1) which is within applicants' range of 1 to 8 psi (6.895 kPa to 55.158 kPa). Sun broadly discloses the use of a chelating agent (col.6, lines 49-54), including the use of carboxyl acids (see claim 10).

Sun fails to disclose the use of water-soluble polymers comprises polymaleic acid (as in claim 1); or that the polymaleic acid comprises a homo or copolymer (as in claim 2).

Sherber teaches analogous art, composition for metal layers and other films during the various stages of multilevel interconnect (i.e. barrier films such as TaN) comprises the conventional use of derivatives from maleic acid, i.e. a water-soluble homopolymer polymaleic acid [evidenced by Wikipedia; Maleic Acid (for solubility) and Changzhou Kejia Chemical Co. (maleic acid is a homopolymer)], because they possess the ability to complex or associate with dissolving metals and improve the removal rate of metal thin films such as titanium, and the like, during the CMP process (see col. 5, lines 43-58).

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to include a water soluble polymaleic acid, as Sherber, when forming the CMP composition of Sun, because Sherber teaches use of derivatives of the water soluble organic acid, maleic acid, possess the ability to complex with the dissolving metals to improve the removal rate of the metal films, a well known process improvement.

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As to claim 4, see Sun's teaching on pH above, also see Sherber's teaching that pH can be increased or decreased for a desired range (col.4, lines 41-42).

It would have been obvious to one of ordinary skill in the art at the time the invention was made, to select any desired range of pH, between 2.5 and 11, as Sun, to provide desired results, as Sherber, because overlapping ranges have been held to be obvious.

As to claim 5, Sun teaches an aqueous chemical mechanical planarizing composition comprising 0.05 to 15 wt % abrasive (col. 7, lines 9-12); 0.1 to 10 wt % oxidizing agent (col. 6, lines 57-59); and 0.02 to 1 wt% benzotriazole (col. 6, lines 59-65) which falls within the range of the instant invention. In addition, Sun et al. clearly discloses pH-adjusting agent/s can adjust the CMP composition to a range of about 2.5 to about 11, which encompassed the claimed less than 4. Sun et al. also clearly explain the adjusting agents can be comprised of bases, inorganic acids, and/or organic acids (col.6, l.66 to col.7, l.3). Furthermore, Sun et al. teaches use of phosphoric and nitric acids as a pH-adjusting agents (col.7, l. 3-4 and l.59). Sun et al. teaches a tantalum nitride removal rate of at least eighty percent of copper removal rate (col.3, lines32-34). Sun cites a 1:0:0 removal rate which indicates that 100% of the barrier layer (i.e. TaN) is removed relative to 0% of the copper and 0% of the dielectric at a pad pressure of 13.8 kPa. (col. 12, line 1) with in Sun's range of 1 to 8 psi (6.895 kPa to 55.158 kPa). Sun's range is within the claimed range.

Sun fails to disclose the use of water-soluble polymers.

Sherber teaches a composition for metal layers and other films during the various stages of multilevel interconnect (i.e. barrier films such as TaN) comprises the conventional use of derivatives from maleic acid, i.e. a water-soluble homopolymer polymaleic acid [evidenced by Wikipedia; Maleic Acid (for solubility) and Changzhou Kejia Chemical Co. (maleic acid is homopolymer)], because they possess the ability to complex or associate with dissolving metals and improve the removal rate of metal thin films such as titanium, and the like, during the CMP process (see col. 5, lines 43-58).

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to include a water soluble polymaleic acid, as Sherber, when forming the CMP composition of Sun, because Sherber teaches use of derivatives of the water soluble organic acid, maleic acid, possess the ability to complex with the dissolving metals to improve the removal rate of the metal films, a well known process improvement.

As to claims 6, see the discussion above toward claim 2.

### ***Response to Remarks***

As to applicants' remarks, on page 3, that Sun fails to disclose the claimed water soluble polymaleic acid of applicants' invention, examiner agrees and relies on the reference of Sherber et al. (5,858,813) to provide maleic acid, i.e. a water-soluble homopolymer polymaleic acid [evidenced by Wikipedia; Maleic Acid (for solubility) and

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Changzhou Kejia Chemical Co. (maleic acid is a homopolymer)], because they possess the ability to complex or associate with dissolving metals.

As to applicants' argument, on page 4, that there is no motivation to combine four slurry formulations with polymer literature, examiner can find no reference in the prior art rejections which combine four slurry formulations. The reference of Sun et al. is relied on for the teaching of a slurry, which meets all of applicant limitations, with the exception of the polymaleic acid. Applicant argues, on page 4 as well as in remarks filed 6/20/2006 and 2/10/2006, that in house chemist, Dr. Liu, that bulk copper slurries teach away use for barrier removal because of the primary function, however examiner stands that although the composition is primarily used to remove metal, is well proven that it is also used to removing tantalum nitride. Applicants' limitations are clearly toward compositions, therefore this line of argument is not persuasive because the tantalum removal rate of the solution is properly ascribed to the solution, and not an active process step.

Applicants' argue, on page 4, as in remarks of 10/21/2005 and 6/20/06, that the reference of Sun et al. does not disclose a second step which operates at a pH below 4, adjusted with an inorganic acid for use in a barrier slurry. Sun et al. clearly discloses pH adjusting agent/s can adjust the CMP composition to a range of about 2.5 to about 11, which encompassed the claimed less than 4. Sun et al. also clearly explain the adjusting agents can be comprised of bases, inorganic acids, and/or organic acids (col.6, 1.66 to col.7, 1.3). Applicants state that this is a technology leap, examiner disagree.

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Applicants point, on pages 4 abridging 5, to another technology leap in the action of 6/18/06, when combining the teachings of Scherber et al. with Sun et al., in particular the modification of a slurry used for metal, with the addition of a maleic acid, readily available and marketed for use as possessing the ability to complex or associate with dissolving metals and improve the removal rate of metal thin films. Examiner disagree as one skilled in the art designing a slurry used with metals, would have the knowledge of the need for such complexing. As too applicants' argument toward the reference of Scherber et al. not disclose use of polymaleic acid (only maleic acid) evidence that maleic acid is in fact a homopolymer polymaleic acid (i.e. poly maleic acid) was/is provided (see the art rejection above).

Applicant's arguments, on page 5, that there is no motivation to combine the bulk copper slurry with the barrier copper slurry of Sun et al.; and Applicants' argue, on page 6, that such a combination would teach away applicants' claimed range of pH, examiner agree, and would like to point out that she relies on only one of the two slurries in the reference of Sun et al. for the prior art rejection offer above.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Colloidal Dynamics; The CMP Slurry Monitor - Background.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patricia A. George whose telephone number is (571)



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272-5955. The examiner can normally be reached on weekdays from 7:00am to 4:30pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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LAN VINH  
PRIMARY EXAMINER

